CLAIMS

1. A rotational moulding machine comprising :

a mould manipulator arrangement [10],

a frame arrangement [18] in the manipulator arrangement [10],

means [42] for locating at least one mould [40] in and removing it from the frame arrangement [18], and

means [20 and 22] for manipulating the frame arrangement [18] by simultaneously rotating it on a first axis A and the mould locating means [42] on a second axis B while the two axes are held normal to each other about a central point in the frame arrangement [18],

characterised in that:

the mould manipulator arrangement [10] includes a base member [12],

two spaced frame arrangement supports [14,16] which are fixed to and project upwardly from the base member [12],

the frame arrangement [18] is a rectangular frame element [18] which carries stub axles [28, 30] which are attached centrally to and project outwardly from two opposite sides of the frame element [18] to be supported by and journaled for rotation, on a common first axis A, in the frame arrangement supports [14,16], and

means [34] for supporting a mould [40], in the frame element [18], including outwardly projecting shaft portions which are journaled for rotation in the remaining opposite sides of the frame element [18] on a second common axis B.

2. A moulding machine as claimed in claim 1 wherein the frame arrangement manipulator includes a first bevelled gear ring [20] which is fixed to a support [39] which is anchored to the base member [12] to be centred on one of the frame element stub axles [28] with the portion of the frame element [18] which carries the stub axle [28] being rotatable in the ring gear [20], a second bevelled gear ring [22] which is meshed with the first [20] and is releasably fixed to the second axis shaft [34] portion on the outside of the frame ~~element~~ [18] to be rotatable about the second axis B of rotation of the frame element

[18], and means for rotating the stub axle [28] on which the first ring gear [20] is centred to cause the frame element [18] to be manipulated.

3. Moulding apparatus as claimed in either one of claims 1 or 2 wherein the mould supporting frame element [18] shaft [34] portion which passes axially through the second ring gear [22] carries a manually operable lock [36] for releasing the ring gear [22] from the shaft [34] portion and its teeth from the teeth of the first ring gear [20] to enable the frame element [18] to be rotated about its first axis A of rotation independently of the first ring gear [20].

4. A moulding machine as claimed in either one of claims 2 or 3 wherein the first ring gear [20] is fixed to its support [39] by formations [38] which each space the ring gear [20] from the support [39] in the direction of the frame element [18] and includes means for adjusting the spacer formation [38] towards and away from its support [39] to ensure optimum engagement of the ring gear [20] teeth with those of the second ring gear [22].

5. A moulding machine as claimed in any one of the above claims wherein the mould locating means is a frame arrangement [42] which is fixed to the frame element [18] shaft [34] portions, which carries the second ring gear [22], and in which the or each mould [40] is releasably located by hand operated clamps which additionally lock opposed mould shells of the or each mould [40] together during the moulding operation.

6. A moulding machine as claimed in any one of claims 2 to 5 wherein the stub axle [28] rotating means includes a drive wheel [32] on an extended portion of the stub axle [28].

7. A moulding machine as claimed in any one of claims 2 to 6 wherein the diameter of the second ring gear [22] is smaller than that of the first [20] and the teeth on the two ring gears [20,22] are uneven in number so that they are not integer multiples of one another.

8. A moulding machine as claimed in any one of the above claims including a carousel base [44] which is rotatable on a floor about a central axis and which carries three of the mould manipulator arrangements [10] of any one of claims 1 to 7 with their base members [12] fixed to the upper surface of the carousel base [44].

9. A moulding machine as claimed in claim 8 wherein the base members [12] of the mould manipulator arrangements [10] are centred at 120° intervals on a circle on the carousel base [44] which is concentric with its axis of rotation.

10. A rotational moulding machine as claimed in either one of claims 8 or 9 wherein the underside of the carousel base [44] carries a circular track which is fixed to it and is centred on the central axis of the base [44] and the machine includes a set of suitably spaced wheel arrangements [54] which are mounted on the floor and which are each adjustable in vertical height by its wheel engaged with the track on the underside of the carousel base [44], and means [52] for index rotating the base [44] on the wheel arrangements [54] in 120° increments about the carousel [44] axis between a heating station [62], a cooling station [64] and a mould stripping and loading station [66].

11. A moulding machine as claimed in claim 10 wherein the heating station [62] includes a heating chamber housing [68] which is shaped to enclose a mould manipulator [10] arrangement on the carousel base [44], means for heating the chamber to a predetermined moulding temperature and a crane [58] which is free of the carousel base with its lifting means [80] adapted to lower the heating chamber [68] onto the heating station [62] position on the carousel base [44] over a mould manipulator arrangement [10] and to lift the chamber [68] from the base [44] to be clear of the mould manipulator arrangement [10] on the completion of the hot moulding cycle of operation of the heating station [62].

12. A moulding machine as claimed in claim 11 wherein the crane [58] includes an overhead crane beam [56] which is free of the carousel base [44] and extends over the centres of the heating and cooling station positions [62,64] on the carousel base [44] and the cooling station [64] includes an open-topped side wall arrangement [74] for surrounding a manipulator arrangement [10] on the carousel base [44], a crane lifting means [80] which is connected to the crane beam for lowering and raising the wall arrangement [74] simultaneously with the heating chamber housing [68] onto and from the carousel base [44] and fans [76] in the wall arrangement [74] for blowing cooling air onto the or each mould [40] in the manipulator frame arrangement [18] when the wall arrangement [74] is on the carousel base [44].

13. A moulding machine as claimed in claim 12 where both the heating station [62] heating chamber housing [68] and the cooling station [64] wall arrangement [74] enclosure carry motors [88] on the outside of their walls for driving friction wheels [90], which when the enclosures [68,74] are lowered by the crane [58] over the mould manipulator arrangements [10] at the station positions [62,64] on the carousel base [44], come into pressure contact with the drive wheels [32] of the manipulator arrangements [10], the

stub axles [28] of which pass through vertical slots in the enclosure walls [70], on the outside of the enclosures [68,74] to cause the manipulator arrangements [10] to manipulate the moulds [40] in the enclosures [68,74].

14. A moulding machine as claimed in claim 13 wherein the side wall arrangement [74] includes jets for spraying misted cooling water into the fan [76] air streams into the space enclosed by the wall arrangement [74] when on the carousel base [44].

15. A moulding machine as claimed in any one of claims 11 to 14 including two heating stations [62], two cooling stations [64] and a single mould stripping and loading station [66], two crane beams [56] which are free of the carousel base [44] with a first of the crane beams [56] located over the centres of the two heating station [62] positions on the carousel base [44] for lowering and raising the heating chamber housings [68] with the second located over the centres of the cooling station [64] positions on the carousel base [44] for lowering and raising the wall arrangements [74] with the crane lifting means [80] on the crane beams [56] being adapted to simultaneously lower and raise the housings [68] and wall arrangements [74] onto and from the carousel base [44].